Pro-Poor Institutions for Development Effectiveness: Cross-Country Empirical Analyses and a Case Study of Ethiopia

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Abstract: This research revisits the discussions of development effectiveness with introducing a new concept "pro-poor institutions" as the key factor. The results of cross-country empirical analyses (using the unbalanced panel data of 183 growth spells of 60 countries during the late 1990s-2000s) reveal that aid works more effectively in countries with positive pro-poor country specific effects, i.e., those with pro-poor institutions. The case study of Ethiopia identifies the various pro-poor factors that are considered to influence development effectiveness. These include strong leadership, ownership of government, decentralization of authority, and equitable public service delivery. Not only growth-enhancing institutions, but also pro-poor institutions, should be taken into consideration for aid allocation, so that it will enhance development effectiveness.
Key Words: Development Effectiveness, Aid, Pro-Poor Institutions, Country Fixed Effects, Ethiopia

1. Background

Effectiveness of development aid has been a controversial issue for decades in the field of development economics. Aid is generally considered to have a positive impact on economic growth, which is believed to be a vital force for poverty reduction. Although some studies have confirmed this positive relationship (Gulati, 1978; Hansen & Tarp, 2000; Clemens, Radelet, Bhavnani. & Bazziz, 2004), others have argued that there is no significant impact by aid on growth (Mosley, Hudson & Horrell, 1987; Bonne, 1996). Moreover, some studies suggested that the impact came with certain prerequisite conditions such as good policies (Burnside & Dollar, 2000; Collier & Dollar, 2001, 2002) and geography (Dalgaard, Hansen, & Tarp, 2004). The current course of discussions asserts the importance of good policies (trade, monetary, and fiscal policies) and institutions (such as ICRG and CPIA[2]) for an effective aid in promoting growth. In fact, these policies and institutions have been used as conditionality or a benchmark for the aid allocation. However, our earlier study showed that institutions as measured by ICRG were negatively associated with incomes of the poor, i.e. anti-poor, even though they tend to promote growth and poverty reduction (through growth), i.e. pro-growth (Hirano & Otsubo, 2012). We came up with the idea that if the country had pro-poor institutions, development effectiveness could be increased. With this concern, this study aims: i) to investigate whether the pro-poor country specific factors, i.e., pro-poor institutions, could be a key for development effectiveness, or not; and ii) to identify potential pro-poor institutions that determine development effectiveness.

2. Methods and Data

2.1 Cross-Country Empirical Analyses

First, we conducted a series of cross-country regression analyses for examining pro-poorness or anti-poorness of institutions and other variables of our concern. We applied the models, which Dollar and Kraay used (2002, Eqs. 1 & 4), to the Eqs. 1 and 2:

a) Estimation by the level relationship for the average income of the poorest quintile.

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[2] International Country Risk Guide (ICRG) from the PRS Group and Country Policy and Institutional Assessment (CPIA) from the World Bank.

$$\ln y^{p}_{ct} = \alpha + \beta \ln y_{ct} + \delta \ln Z_{ct} + \theta \ln A_{ct} + \mu_c + \lambda_t + \varepsilon_{ct} \quad (1)$$

b) Estimation for the growth rates of average income of the poorest quintile (or QX).

$$(\ln y^{p}_{ct} - \ln y^{p}_{c0})/T = \beta(\ln y_{ct} - \ln y_{c0})/T + \delta \ln Z_{ct} + \theta \ln A_{ct} + \lambda_t' + \varepsilon_{ct}' \quad (2)$$

c) Estimation with the possible convergence in inequality.

$$(\ln Gini_{ct} - \ln Gini_{c0})/T = \alpha + \beta_1 \ln Gini_{c0} + \beta_2[(\ln y_{ct} - \ln y_{c0})/T] + \delta \ln Z_{ct} + \theta \ln A_{ct} + \lambda_t' + \varepsilon_{ct} \quad (3)$$

where, c and t: countries and years, y: average per capita income of the county, y^p: average per capita income of the poorest quintile or other quintile groups, Z: important factors including institutional quality and policies, A: period average aid (economic aid, social aid, and aggregate aid)/GDP, μ_c: unobserved country fixed-effects, and $\lambda + \varepsilon$: a composite error term.

Second, by estimating Eq.1 in the fixed effects model, we obtained the pro-poor country fixed effects, i.e., pro-poor institutions. We investigated the impact of aid by i) countries with positive pro-poor country fixed effects and ii) countries with negative pro-poor country fixed effects.

2.2 Data for Empirical Analyses

The growth spells of medium terms are compiled from the available data points of bottom-quintile income shares during 1978-2010. This contains 242 growth spells of the 5-9-year period each with the average duration of 5.72 years from 99 countries during 1978-2010. The data for sectoral aid analysis contains 183 growth spells for 60 countries during the late 1990s-2000s. Most of the data comes from WDI, except ICRG from the PRS Group, and aid data from the OECD-DAC CRS database. For the index of institutional quality, we formed the "capacity" sub-composite (ICRG-Capacity) by compiling the particular five components: (i) government stability; (ii) investment profile; (iii) corruption; (iv) law and order; and (v) bureaucracy quality. These five indicators denote the management ability of recipient countries.

2.3 A Case Study of Ethiopia

We singled out Ethiopia for our case study as she had the outstanding pro-poor country fixed effects among our sample sets. We conducted a field survey in Ethiopia during July-August, 2013 in order to find out the country uniqueness and pro-poor institutions through the semi-structured interviews with government officers, researchers, development practitioners, commodity exchange agents, institutions for industrial/business development, and public/foreign companies.

3. Results of Cross-Country Empirical Analyses

3.1 Growth Enhancing Institutions Tend to be Anti-Poor

We conducted a country fixed effects regression with Eq.1 in order to examine the pro-/anti-poor effects of institutions and other variables. We found that the coefficient of institutional quality (ICRG-Capacity) was negative with significance (Table 1, Column 6). We also conducted the quintile regressions with Eq.2 in order to estimate the systematic effects of institutions on Quintile 1-5 groups (Table 2). We found some clear tendencies, despite the lack of statistical significance that institutional quality (ICRG-Capacity) tends to benefit the richest quintile more than any other income groups. On the other hand, the impact of institutional quality on the poor was negative with moderate significance (Table 3a, Q1). The anti-poorness of institutions was also

robust with Eq.3. These results indicate that growth-enhancing institutions (ICRG-Capacity) tend to be anti-poor apart from its effects through growth.

3.2 Aid Works More Effectively in a Country with Pro-Poor Institutions

First, the fixed effects were obtained from the C13 of Table 1. As listed in Table 3, we identified Ethiopia, Tajikistan, Nepal, Pakistan, and Bangladesh, as the countries with the high pro-poor country fixed effects, i.e., pro-poor institutions. We also identified that Panama, Brazil, Columbia, Seychelles, Argentine, and Bolivia were the countries with the least pro-poor fixed effects. We examined the development effectiveness by different groups with the positive or negative pro-poor country fixed effects. We found that the effectiveness of social and aggregate aid was positive and more significant in countries with a positive pro-poor fixed effect (C3 &5) while its significance decreased in countries with a negative pro-poor fixed effect (C4 &6). We also found the significance of aggregate aid and social aid was much larger in comparison with economic aid (C1, 3, &5). In general, aggregate aid (which includes food assistance and humanitarian assistance) and social aid are more targeted for poverty reduction. We could interpret that the aid could not be extended to the poor, if there is no pro-poor institutions in a developing country. This study suggests providing aid to a country with pro-poor institutions would increase development effectiveness.

4. Findings from the Case Study of Ethiopia

Ethiopia is one of the poorest countries in the world; nevertheless, she has achieved significant progress in reducing poverty and inequality after the drastic reform in the early 1990s. The government's strong commitment and strategic measures for socioeconomic development pushed the country forward with effectively utilizing foreign development aid. We found from the field survey that successful poverty reduction and high development effectiveness were greatly influenced by the various pro-poor nature of the country, which were rarely captured in the current measurement of institutions in the aid literatures. These include decisive and effective leadership committed for poverty reduction, strong ownership of government, decentralization of authority and service delivery, and pro-poor and equitable public expenditures.

5. Conclusion and Policy Recommendations

This study proposes a new perspective on development effectiveness. We argue the pro-poor institutions could be the key determinants of development effectiveness, unlike the previous literatures that focus on growth-enhancing policies and institutions. We suggest to the policy makers and people in the development community to take into consideration not only growth-enhancing policies and institutions, but also pro-poor institutions, in allocating aid, so that development effectiveness will be further increased.

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Table 1 Impact of Aid, Policies, Institutions on the Poor (Inequality; Level Rgressions)

Dependent Variable: Ln(Per Capita Income of the Poorest Quintile)													
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Constant	-4.1807***	-4.1483***	-4.1572***	-3.9777***	-4.1590***	-3.8242***	-5.5216***	-5.6357***	-5.8752***	-2.9829***	-5.6432***	-5.7573***	-6.0209***
	(6.49)	(6.10)	(6.26)	(4.20)	(5.46)	(5.49)	(5.64)	(5.81)	(6.06)	(3.45)	(4.69)	(4.82)	(5.05)
Ln(Per Capita Income) (real terms) #	1.1794***	1.1763***	1.1783***	1.1511***	1.1678***	1.1590***	1.3675***	1.3772***	1.4056***	1.1606***	1.3815***	1.3912***	1.4232***
	(13.19)	(12.52)	(12.24)	(8.91)	(10.49)	(12.74)	(9.93)	(10.08)	(10.35)	(12.94)	(8.23)	(8.33)	(8.59)
Government Consumption/GDP			-0.0015							-0.0092			
			(0.27)							(1.34)			
Ln(1 + Period Average Inflation/CPI)				-0.00099							0.0779	0.0785	0.0892
				(0.07)							(0.46)	(0.47)	(0.54)
Trade/GDP					0.0004								
					(0.37)								
Institutional Quality (ICRG Capacity)						-0.0069*				-0.2757*			
						(1.80)				(1.96)			
Economic Aid/GDP							-0.0023				-0.0067		
							(0.17)				(0.38)		
Social Aid/GDP								0.0188***				0.0193***	
								(3.39)				(3.56)	
Aggregate Aid/GDP									0.0152***				0.0152***
									(5.43)				(5.34)
Crises Dummy		-0.0185	-0.0163	-0.0233	-0.0109	-0.0052	-0.0199	-0.0232	-0.0194	-0.00006	-0.0250	-0.0268	-0.0234
		(0.87)	(0.71)	(1.00)	(0.52)	(0.25)	(0.80)	(0.92)	(0.79)	(0.003)	(0.93)	(1.02)	(0.91)
No. of Observations	211	211	203	193	190	187	180	182	182	182	164	166	166
R-squared	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Source: Authors' own compilation

Table 2 Impact of Changes in Institutional Quality on the Quintile Income Groups (Level Rgressions)

a) the Late 1990s-2000s

Dependent Variable: Period Average Growth Rate of Per Capita Income of the Quintile (real terms)						**b) the 1970s-2000s**				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
Period Average Growth Rate of	1.1674***	1.0712***	1.0526***	1.0261***	0.9668***	1.1336***	1.0702***	1.0412***	1.0160***	0.9786***
Per Capita Income #	(13.74)	(23.35)	(30.87)	(39.62)	(25.80)	(11.82)	(16.47)	(21.28)	(32.06)	(18.96)
Period Average Rate of Change of	-0.1892	-0.1067	-0.0622	-0.0241	0.0506	-0.11111	-0.0508	-0.0302	-0.0111	0.0315
Institutional Quality (ICRG Capacity)	(1.59)	(1.48)	(1.29)	(0.82)	(0.94)	(1.34)	(1.17)	(1.05)	(0.54)	(1.10)
Crises Dummy	-0.0028	-0.0008	-0.0002	-0.000009	-0.0005	-0.0022	-0.0009	0.00004	0.0004	-0.0004
	(0.66)	(0.31)	(0.13)	(0.01)	(0.26)	(0.50)	(0.35)	(0.02)	(0.31)	(0.23)
No. of Observations	126	126	126	126	126	186	186	186	186	186
R-squared	0.45	0.70	0.82	0.90	0.82	0.43	0.59	0.73	0.87	0.71

Notes: Quintiles go from the poorest, Q1 to the richest Q5. *Source:* Author's compilation

Table 3 Pro-Poor Country Fixed Effects

Rank	Country Code	Effect
1	ETH	1.3805
2	TJK	1.0473
3	NPL	0.9995
4	PAK	0.9876
5	BGD	0.9860
6	MWI	0.9338
7	BDI	0.9155
8	MLI	0.8517
9	GNB	0.8276
10	BFA	0.8187
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.		
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69	VEN	-0.8024
70	BLZ	-0.8651
71	HND	-0.9403
72	ZAF	-0.9498
73	BOL	-1.0209
74	ARG	-1.1046
75	SYC	-1.1136
76	COL	-1.1351
77	BRA	-1.1742
78	PAN	-1.2554

Source: Authors' own compilation

Table 4 Impact of Aid on the Poor by Countries with Pro-Poor Fixed Effects

Dependent Variable: Ln(Per Capita Income of the Poorest Quintile)						
	Economic Aid		Social Aid		Aggregate Aid	
Pro-Poor Country Fixed Effects	Positive	Negative	Positive	Negative	Positive	Negative
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-3.4638***	-8.2871***	-3.5905***	-8.6277***	-4.0518***	-8.5907***
	(3.77)	(5.44)	(4.04)	(5.52)	(4.38)	(5.57)
Ln(Per Capita Income) (real terms) #	1.1242***	1.6235***	1.1340***	1.6584***	1.1973***	1.6536***
	(8.11)	(8.55)	(8.39)	(8.53)	(8.58)	(8.62)
Aid/GDP	-0.0052	-0.1913***	0.0185***	0.0406**	0.0136***	0.0179*
	(0.46)	(3.03)	(3.46)	(2.44)	(5.32)	(1.96)
Crises Dummy	-0.0193	-0.0527	-0.0247	-0.0730**	-0.0149	-0.0719**
	(0.57)	(1.62)	(0.74)	(2.09)	(0.45)	(2.05)
No. of Observations	97	65	99	65	98	65
R-squared	0.99	0.99	0.99	0.99	0.99	0.99

Source: Authors' own compilation

Notes: i) Absolute value of t-statistics calculated with White-corrected standard errors is in parentheses.
*, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.
ii) Panel two-stage least squares methods is used for these analyses.
iii) # denotes variables are instrumented with the value of the previous year.

Promoting Agroindustry-led Development under Globalization: Simulations with a CGE model for the Democratic Republic of Congo

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Keywords: agroindustry, Free trade agreement, Productivity growth, CGE

1. Introduction

Donor agencies and policy-makers agreed that agriculture and agro-industry are important value-adding business sectors, with a highly positive development impact, and with a great contribution to developing countries' economic growth. According to the World Bank, Africa's agriculture and food market is worth 310 billion US Dollars and has the opportunity to grow to 1 trillion US dollars by 2030. Given this potential, many African countries made progress in improving agriculture productivity and strengthening technological effort to foster the development of agribusiness. In addition, African states have increased political commitment to increase investment in agriculture and remove institutional constrain to agriculture and agribusiness. Despite of the progress being made, the region is still a long way from taking full advantage of the opportunities to boost agribusiness, as regional integration and regional industrial policy are not working well and domestic market are very small.

Therefore this paper explores how African countries can exploit local, regional and international demand to seize opportunities for promoting agroindustry, using a computable general equilibrium model applied to the Democratic Republic of Congo. The Congo is a special study case for two policy reasons: First, it has a huge potential for agriculture and geo-location: 80 million hectares of arable land, diverse climatic conditions, abundant water resources, and 8 neighbouring countries. Second, the Congo has signed a number of regional agreements, without, however, implementing their free-trade protocols.

2. Methodology and Data

This paper uses a global – national computable general equilibrium model to study how the Congo can use the force of globalization to reinforce its industrial policy. Our methodological framework is built on three stages. First, we use a national CGE model to simulate a policy package to increase productivity and output of agrofood industry. This policy package comprises a joint simulation of productivity in processed food, a creation of trade promotion unit which aims at reducing supply constrain to market, an investment of road infrastructure which reduce domestic transaction costs, an import licensing to protect infant industry, and an agriculture input reform. This joint simulation is used as scenario 1 (base run) in this study. Further details of this simulation can be found in Otchia (2013). In the second stage, we use the GTAP model to simulate possible FTAs under which the DRC can promote its industrial policy. In the last stage, we link the GTAP model to the national CGE to jointly simulate agrofood scenario with FTA in order to assess under which FTA the agrofood scenario yields the greatest gain. We link the two models as follows: The changes in demand for exports, export prices, and import prices, as obtained from the GTAP model, are communicated to sectors of the Congo CGE model following Horridge and Zhai (2006).

The CGE of the DRC is fully documented in Otchia (2014a). The model is a single country, static CGE model which contains 19 productive activities. Those activities combine intermediate commodities and primary factors

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using a Constant Elasticity of Substitution (CES) function to determine a level of output. Factors of production include capital, urban high-skilled labour, urban semi-skilled, urban low-skilled, rural high-skilled labour, rural semi-skilled, and rural low-skilled. The model assumes that the choice of factors of production is governed by a CES function, while the aggregate intermediate input is a Leontief function of disaggregated intermediate inputs. The output is split into domestic goods and goods for foreign markets using a constant elasticity of transformation (CET) function. In the domestic market, domestic goods can be substituted with imports following the Armington CES function. Domestic demanders are assumed to minimize the cost base on the relative prices of imports and domestic goods. They demand the composite good according to the linear expenditure system derived from the maximization of a Stone-Geary utility function subject to a household budget constraint.

In our experiments, we assume that tax rates are fixed, and real consumption expenditure is exogenously determined. Therefore, fiscal deficit adjusts to ensure that government account balances. The rest of the world balance is achieved by assuming flexible exchange rate maintains a fixed level of foreign savings, given the free floating exchange rate system adopted in the Congo. This assumption has the following implications: governments cannot simply pay for new imports by increasing foreign debt. Instead, they have to generate exports earnings to pay for any additional imports. For savings-investment balance, the simulations assume that savings are investment-driven but with adjustment rule for government consumption. This closure assumes also that saving rates of selected institutions are adjusted by an equal number of percentage points. In addition, we assume that labour is fully employed and mobile across sectors. Domestic price is the numéraire. The model is calibrated to a 2005 SAM for the Democratic Republic of Congo by the author.

3. Design of Policy Experiments

In this section, we examine how the Congo can exploit local, regional and international demand to seize opportunities for promoting agrofood industry. A total of seven scenarios are simulated, of which one focuses on the agrofood development (scen.1), and six on FTAs (Scen.2-7). Among the six FTA experiments, four are related to the Tripartite COMESA-SADC-EAC (Scen.2-5), and two on the prospect African Continental Free Trade Area (ACFTA). Scenario 2 explores the opportunity to promote agrofood industry under Tripartite COMESA-SADC-EAC. Scenario 3 builds on scenario 2 and includes China, while scenario 4 and 5 include respectively BRICS (exclude China) and the EU15. On the other hand, scenario 6 assesses the strategies of promoting agrofood within the prospective African Continental Free Trade Area. Similarly, scenario 7 builds on scenario 6 and adds China. The simulations design is summarised in table 1.

4. Impact Analysis of the Experiments

4.1. Macro Impacts

Macro results of policy experiments described in the previous section are reported in table 2. As can be seen, the impact of agrofood development is an increase in the size of the Congolese economy. Real GDP increases by 5.4 per cent. Government consumption, investment, and total welfare also increase. Imports and exports decrease but those changes are very small. Table 2 further indicates that promoting agrofood industry under different FTAs agreement will benefit to the Congo's economy, except under FTA with EU15. In fact, GDP expands by 3.9% when agrofood is promoted under Tripartite + EU15 while GDP would grow higher under Tripartite alone or without any trade agreement. Unexpectedly, Tripartite and ACFTA gives the same change in terms of GDP even though welfare effects are higher under ACFTA due to price changes. In all cases, FTAs with China result in a relatively higher GDP growth and welfare gains. Imports grow to a lower extend than under FTAs with EU or BRICS*.

4.2. Impacts on Production

Table 3 summarizes the results of policy experiments on production structure. Looking on the column of scenario 1, we observe that agrofood development scenario induces growth in agriculture sector and forestry sectors as they provide inputs to agrofood industry. The value-added on agriculture increases by 10.6 per cent while forestry sector expands by 2.7 per cent. The remaining sector also expands. Wood and non-metals grow by 5.4 per cent and 3.1 per cent respectively, whereas utilities, trade, and hotel and catering grow by 5.2, 2.2, and 3.9 per cent. Under FTAs scenarios, we can see that ACFTA will procure the higher rise in valued-added than under Tripartite. This implies that policy in favour of greater integration within African can reinforce the impact of domestic industrial policies. But FTAs should be negotiated case by case and be more dynamic as comparative advantages are moving. For instance, we observe in table 3 that wood and mining value-added decreases significantly as we move from Tripartite to ACFTA. Again FTAs with China seems to procure the highest rise in value-added for food processed. Note that agriculture's expansion is similar under Tripartite with China and ACFTA + China. This indicates that agriculture capacity to expand might be limited. There is therefore a need to support sectors that add value addition to agriculture products. It is worth mentioning that even if Tripartite with EU15 gives the lowest impact in many sectors, this agreement provided the highest benefit for agriculture and construction.

4.3. Impacts on factor market

With regards to factor income, table 4 indicates that agrofood-led development increases the return to all factors. Rural highskilled and urban lowskilled benefit the most. All the FTAs with the exception of Tripartite + China procures high benefit to urban workers. Under Tripartite with EU15, rural lowskilled and semiskilled factor income decrease by 6.9 and 7.9 per cent respectively.

5. Policy Implications

The experiments carried out highlight the potential of globalization (viewed as FTAs) in reinforcing the impact of domestic agrofood development policy. The results suggest that while FTAs may procure welfare gains and new markets opportunity for picked sectors, some infant industry may also lose from increased competition. Therefore, FTAs should be very flexible to account for dynamic comparative advantage.

6. Selected Reference

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7. Appendix

Table 1: Design of Policy Experiments

Scenarios	Description
Scen. 1	Agroindustry-led development
Scen. 2	Agroindustry-led development under Tripartite (COMESA - SADC – EAC) FTA
Scen. 3	Agroindustry-led development under Tripartite + China FTA
Scen. 4	Agroindustry-led development under Tripartite + BRICS (without China) FTA
Scen. 5	Agroindustry-led development under Tripartite + EU15 FTA
Scen. 6	Agroindustry-led development under African Continental Free Trade Area (ACFTA) FTA
Scen. 5	Agroindustry-led development under ACFTA + China FTA

Source: Author

Table 2: Impact on Macro variables

	Scen.1: Agrofood	**Scen.2:** Agrofood under Tripartite	**Scen.3:** Agrofood under Tripartite + China	**Scen.4:** Agrofood under Tripartite + Brics*	**Scen.5:** Agrofood under Tripartite + EU	**Scen.6:** Agrofood under ACFTA	**Scen.7:** Agrofood under ACFTA + China
Gross Domestic Product	5.4	6.0	6.5	6.3	3.9	6.0	6.7
Government consumption	3.2	7.8	6.6	6.5	16.2	13.1	11.5
Investment	2.5	9.6	7.1	7.6	22.7	16.6	14.8
Exports	-0.5	-6.3	-5.8	-5.8	-25.0	-13.7	-11.9
Imports	-0.5	7.4	4.7	5.8	28.2	16.7	14.7
Consumer price index	0.0	-2.0	-1.0	-1.6	-7.4	-4.5	-3.6
Exchange rate	2.8	-15.1	-4.0	-10.5	-52.3	-33.8	-24.7
Welfare (% of GDP)	5.2	8.1	8.2	11.5	12.8	10.9	12.2

Table 3: Impact on production structure

Sectors	**Scen.1:** Agrofood	**Scen.2:** Agrofood under Tripartite	**Scen.3:** Agrofood under Tripartite + China	**Scen.4:** Agrofood under Tripartite + Brics*	**Scen.5:** Agrofood under Tripartite + EU	**Scen.6:** Agrofood under ACFTA	**Scen.7:** Agrofood under ACFTA + China
Agriculture	10.56	10.76	10.81	10.77	10.90	10.80	10.81
Forestry	2.70	3.45	2.66	-1.32	-0.05	3.67	3.32
Mining	2.31	-0.19	5.87	2.19	-24.43	-4.64	-1.02
Processed foods	10.01	10.17	10.29	10.19	9.58	10.47	10.74
Textiles	0.62	2.32	2.06	2.20	3.62	3.62	3.65
Wood	5.40	-13.41	-37.26	-24.57	-39.17	-22.91	-37.32
Chemicals	-0.95	-1.08	-0.66	-1.05	-2.82	-1.32	-0.81
Non-metals	3.06	0.95	0.00	-0.18	0.02	1.37	1.25
Other manufacture	1.94	4.41	4.63	4.70	5.15	5.66	7.10
Utilities	5.17	5.67	8.70	2.03	-5.11	5.01	6.29
Construction	2.41	8.87	6.62	7.07	20.47	15.15	13.56
Trade	2.16	2.77	2.26	2.18	8.88	4.69	3.60
Hotels and catering	3.86	6.02	6.54	6.48	4.75	7.58	8.10
Transportation	-0.46	-0.27	-1.12	-0.83	-0.15	-0.77	-1.12
Education and health	3.24	5.97	5.76	5.48	8.74	8.43	8.36
Financial intermediation	2.40	3.01	3.53	2.55	0.43	5.38	3.72
Other services	0.57	0.79	0.21	0.48	0.09	1.08	0.68
Personal and other community services	5.47	15.30	17.80	28.46	11.44	13.49	30.66
Private households with employed persons	4.00	5.26	5.97	5.37	3.51	5.85	6.71

Table 4: Factor income

	Scen.1: Agrofood	**Scen.2:** Agrofood under Tripartite	**Scen.3:** Agrofood under Tripartite + China	**Scen.4:** Agrofood under Tripartite + Brics*	**Scen.5:** Agrofood under Tripartite + EU	**Scen.6:** Agrofood under ACFTA	**Scen.7:** Agrofood under ACFTA + China
Urban lowskilled	7.00	12.46	11.19	11.11	25.51	18.51	17.91
Urban semi-skilled	5.61	9.68	10.45	10.34	10.85	12.10	14.19
Urban highskilled	5.22	10.61	11.50	15.34	5.28	10.69	18.08
Rural lowskilled	6.95	7.47	11.50	8.08	-6.83	5.86	9.17
Rural semi-skilled	6.92	8.11	13.89	10.62	-7.82	6.45	11.36
Rural highskilled	7.25	10.57	13.58	11.19	5.63	11.79	15.16
Capital	5.11	7.52	7.51	6.79	8.75	9.48	9.46

Spatial Dimension of Innovation in Developing Countries: The State of Innovation in the 17 Regions of the Philippines

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Keywords: innovation, spatial disparity, regional development, research and development, human capital

1. Introduction

The Philippines economy is on the upbeat trend despite the global economic slowdown. It posted 7.6 percent growth during the first half of 2013. The Philippines have also achieved upgraded investment-grade credit from major credit rating agencies such as Fitch and Moody's. The country is also poised to attain the self-sufficiency in rice by the end of 2013. Despite the remarkable resiliency to worldwide economic decline, the country remains low in innovation, which is widely accepted as a significant driver in economic growth. In the recent Global Innovation Index 2013, the Philippines jumped places from 95th to 90th; however, this ranking is comparable only with the African countries of Uganda (89) and Botswana (91).

Many studies have been done to explain this dismal state of innovation in the Philippines; however, there are very few studies that take in to account the spatial dimension of the issue. This study aims to fill this research gap by analyzing the state of innovation at the regional level as it adheres to the notion that innovation is spatially-bounded. This study will examine the state of innovation at 17 regions of the country by constructing an Innovation Index and utilizing Principal Component Analysis (PCA).

2. Data and Methodology

The Oslo Manual defines innovation as, "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations" (Oslo Manual, p.46). There are different ways to measure innovation and the most of widely used are the Oslo and Bogota Manual. Unfortunately, many guidelines were not applicable to developing countries and availability of data is quite problematic. Thus, in order to capture the state of innovation in the developing countries, improvisation is needed. This study used the following indicators from Department of Science and Technology (DOST), Commission on Higher Education (CHED), and Department of Trade and Industry (DTI) to construct innovation index at the regional level. Each variable is standardized but no assignment of weights was used.

Human Capital: R&D Personnel (Public, Private, and Non-profit), Higher Education Institutions

(HEI) Enrollment, Percentage of Faculty with Advanced degrees (MS and PhD) in State Universities and Colleges (SUC)

R&D Intensity: R&D Expenditure (Public, Private, Non-profit, and Industry)

R&D Institutions: Number of micro, small, and medium enterprises (MSME), and Number of HEI (Public and Private)

Principal Component Analysis (PCA) is used to discern the set of variables in two-dimensional space. This representation could give a meaningful classification of regions. PCA is also used to determine the correlation among the variables.

3. Results and Discussion

Based on the constructed innovation index, the state of innovation is quite high in three adjacent regions of National Capital Region (NCR), Region IV-A (Calabarzon), and Region III (Central Luzon). Innovation is also relatively favorable in the neighboring regions of Region VI (Western Visayas), and Region VII (Central Visayas). This observation implies the possibility of knowledge spillovers between or among these regions. While the regions in Mindanao lag significantly in terms of innovation, particularly, CARAGA and Autonomous Region of Muslim Mindanao (ARMM). This particular finding indicates that proximity matters in innovation.

Table 1. State of Innovation at Regional Level

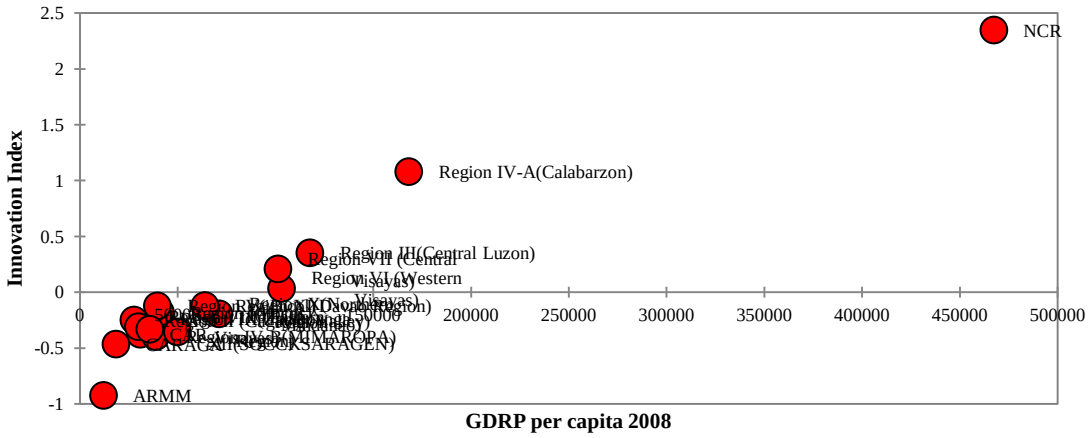
Regions	Innovation Index	Ranking	Human Capital	R&D Intensity	R&D Institutions
NCR	2.348	1	2.437	2.630	1.976
CAR	-0.377	14	(0.007)	(0.333)	(0.791)
Region I(Ilocos)	-0.178	8	(0.007)	(0.304)	(0.222)
Region II (Cagayan Valley)	-0.249	10	0.176	(0.302)	(0.622)
Region III(Central Luzon)	0.353	3	0.176	(0.040)	0.923
Region IV-A(Calabarzon)	1.080	2	0.278	1.267	1.695
Region IV-B(MIMAROPA)	-0.397	15	(0.727)	(0.221)	(0.245)
Region V(Bicol)	-0.122	7	(0.112)	(0.317)	0.062
Region VI (Western Visayas)	0.034	5	(0.251)	(0.151)	0.503
Region VII (Central Visayas)	0.209	4	0.546	(0.062)	0.142
Region VIII (Eastern Visayas)	-0.309	11	(0.267)	(0.311)	(0.349)
Region IX(Zamboanga Region)	-0.332	12	(0.543)	(0.348)	(0.105)
Region X(Northern Mindanao)	-0.194	9	(0.195)	(0.239)	(0.147)
Region XI(Davao Region)	-0.120	6	0.295	(0.162)	(0.492)
Region XII(SOCCKSARAGEN)	-0.356	13	(0.156)	(0.313)	(0.598)
CARAGA	-0.465	16	(0.150)	(0.385)	(0.860)
ARMM	-0.925	17	(1.494)	(0.410)	(0.870)

source: Author's calculation based from the data from Department of Science and Technology(DOST), Commission on Higher Education(CHED), and Department of Trade and Industry(DTI)

The study also found a strong correlation between region's economic development and innovation. Regions with higher gross regional domestic product (GRDP) per capita also exhibits higher

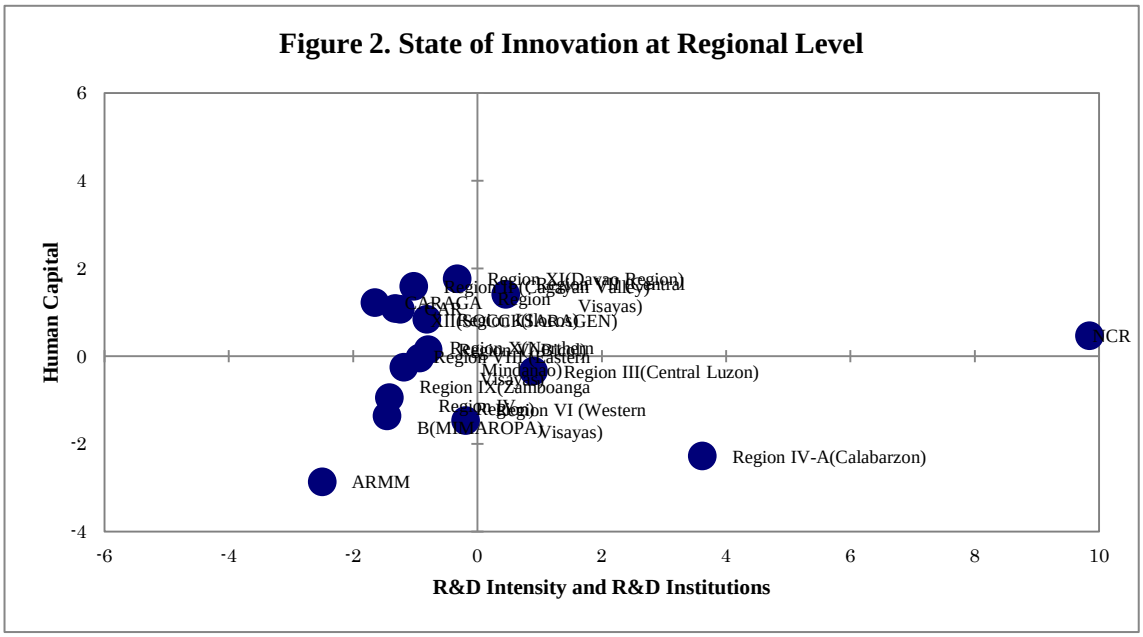
innovation index. NCR has the highest GRDP per capita and also ranks number one in innovation index. ARMM, which has the lowest GRDP per capita, ranks the lowest in the innovation index.

Figure 1. Innovation Index and GRDP Per Capita



For the 17 regions, the first principal component (PC) accounts for 70.66 % of the total variance with Eigen-value significantly larger than 1, the second principal components accounts for 16.51% with Eigen-value higher than 1. These first two principal components explain 87.17 % of the total variance. The first component emphasizes R&D expenditure and R&D Institutions and the second component highlights human capital, particularly, the percentage of the faculty with advanced degrees (MS and PhD) or the quality of human capital.

The higher the R&D expenditure and the number of R&D institutions, the higher the score of first PC on the x-axis, and the regions which has these characteristics are found on the right part of the graph. Meanwhile, the regions with higher percentage of faculty with advanced degrees demonstrate a higher score in the second PC on y-axis. This representation yields a classification of the regions in the Philippines: highly-innovative region (high supply and quality of human capital, vibrant R&D and strong presence of R&D institutions), R&D intensive but relatively deficient in quality of human capital regions, High in quality of human capital-rich but low in R&D regions, and lagging regions (inadequate human capital, R&D, and R&D institutions). NCR is the only region that falls under the category of highly-innovative regions; while the rest of the regions clustered in two categories which is either lacking in the quality of human capital or R&D expenditure and R&D institutions. In order for the Philippines to sustain accelerated growth and achieve inclusive growth, massive effort should be undertaken to address this spatial disparity in innovation.



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